

We Claim:

1. (Currently Amended) A combination of a fuel and a lubricant for an internal combustion engine, said fuel and lubricant comprising:

(a) an emulsified fuel comprising (1) water, (2) a fuel and (3) an emulsifier wherein the emulsifier comprises:

(i) at least one fuel-soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine including ~~but not limited to~~ alkanol amine, hydroxy amine, ~~and the like,~~ the hydrocarbyl substituent of said acylating agent having about 50 to about 500 carbon atoms;

(ii) a second (meaning another acylating agent than in (i)) acylating agent having at least one hydrocarbyl substituents of up to about 40 carbon atoms, and reacting that said acylating agent with ammonia or an amine;

(iii) at least one of an ionic or nonionic compound having a hydrophilic-lipophilic balance (HLB) of about 1 to about 40;

(iv) a mixture of (i) with (ii) or (iii);

(v) a water-soluble compound selected from the group consisting of amine salts, ammonium salts, azide compounds, nitrate esters, nitramine, nitro compounds, alkali metal salts, alkaline earth metal salts, in combination with (i), (ii), (iii), (iv), (vi) or (vii) or combinations therein;

(vi) the reaction product of polyacidic polymer with at least one fuel soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia, an amine, a polyamine, an alkanol amine or hydroxyl amines;

(vii) an amino alkylphenol which is made by reacting an alkylphenol; or

(viii) any combination of (i), (ii), (iii), (iv), (v), (vi) and (vii);

(b) at least one lubricant selected from the group consisting of low ash, no ash, low phosphorous, no phosphorous, low sulfur, no sulfur, low chlorine and combinations thereof in an oil of lubricating viscosity supplying lubricants to one or more parts in the engine, wherein said lubricant is characterized as having an ash content below 1.0 wt%; resulting in the reduction of engine emissions selected from the group consisting of particulate matter, NOx, hydrocarbons, soot and combinations thereof.

2. (Currently Amended) The combination of claim 1 wherein said fuel is selected from the group ~~comprising hydrocarbonaceous petroleum distillate fuel selected from the group~~ consisting of gasoline, diesel, kerosene, naphtha, aliphatics, paraffin and combination thereof; non-hydrocarbonaceous materials selected from the group consisting of alcohols, methanol, ethanol, ether, ethanol ether, diethyl ether, methyl ethyl ether, organo-nitro compounds and combinations thereof; fuels derived from vegetable sources selected from the group consisting of corn, alfalfa, shale, coal and combinations thereof; fuels derived from minerals and mixtures thereof; gas to liquid fuels; mixtures of one or more hydrocarbonaceous fuels and one or more non-hydrocarbonaceous materials; and combinations thereof.

3. (Original) The combination of claim 1 wherein the lubricant is in a base oil stock selected from the group comprising, synthetic base oil, poly alpha olefin base oil, mineral oil, at least 50% synthetic base oil, hydrocarbon oil group 1 base stock, hydrocarbon group 2 base stock, hydrocarbon group 3 base stock, hydrocarbon group 4 base stock and combinations thereof.

4. (Original) The combination of claim 1 wherein the emulsifier comprises a mixture of: the reaction product of a fatty acid with an alkanol amine; and the reaction product of a polyisobutene substituted succinic acid or anhydride with an alkanol amine or an alkylene polyamine, the polyisobutene substituent having a number average molecular weight of about 300 to about 3000.

5. (Original) The combination of claim 1 wherein the emulsifier comprises a mixture of: the product made from the reaction of a polyisobutene-substituted succinic acid or anhydride with an alkanol amine wherein the polyisobutene group has a number average molecular weight of about 1500 to about

3000; the product made from the reaction of a hydrocarbon-substituted succinic acid or anhydride with an alkanol amine wherein the hydrocarbon substituent has about 12 to about 30 carbon atoms; and the product made from the reaction of a polyisobutene-substituted succinic acid or anhydride with at least one alkylene polyamine wherein the polyisobutene group has a number average molecular weight of about 750 to about 1500.

6. (Original) The combination of claim 1 wherein the emulsifier comprises (I) a first polycarboxylic acylating agent having at least one hydrocarbon substituent of about 6 to about 500 carbon atoms, (II) a second polycarboxylic acylating agent optionally having at least one hydrocarbon substituent of up to about 500 carbon atoms, the polycarboxylic acylating agents (I) and (II) being the same or different and being linked together by (III) a linking group derived from a compound having two or more primary amino groups, two or more secondary amino groups, at least one primary amino group and at least one secondary amino group, at least two hydroxyl groups, or at least one primary or secondary amino group and at least one hydroxyl group, the polycarboxylic acylating agents (I) and (II) being reacted with ammonia, an amine, a hydroxyamine, an alcohol, water, or a mixture of two or more thereof.

7. (Original) The combination of claim 1 wherein the emulsifier comprises a polyisobutene substituted succinic acid.

8. (Original) The combination of claim 1 wherein the emulsifier comprises
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C₉-C₁₁ alkoxy poly (ethoxy)₈ alcohol; C₁₂-C₁₅ alkoxy poly (isopropoxy)₂₂₋₂₆ alcohol; oleyl alcohol pentaethoxylate; diglycerol monooleate; diglycerol monostearate; polyglycerol monooleate; polyethylene glycol distearate; polyethylene glycol dioleate; polyethylene glycol soya bean oil ester; glycerol monooleate; glycerol dioleate; diglycerol dioleate; diglycerol distearate; polyglycerol dioleate; sorbitan monooleate; sorbitan monoisostearate; sorbitan sesquioleate; sorbitan trioleate; polyethoxy glycerol trioleate; or a mixture of two or more thereof.

9. (Currently Amended) The combination of claim 1 wherein the emulsifier comprises an alkylaryl sulfonate, amine oxide, carboxylated alcohol ethoxylate, ethoxylated amine, ethoxylated amide, glycerol ester, glycol ester,

imidazoline derivative, lecithin, lecithin derivative, lignin, lignin derivative, monoglyceride, monoglyceride derivative, olefin sulfonate, phosphate ester, phosphate ester derivative, propoxylated fatty acid, ethoxylated fatty acid, propoxylated alcohol or alkyl phenol, sucrose ester, sulfonate of dodecyl or tridecyl benzene, naphthalene sulfonate, petroleum sulfonate, tridecyl or dodecyl benzene sulfonic acid, sulfosuccinate, sulfosuccinate derivative, or mixture of two or more thereof, each of these compounds having a hydrocarbon group of at least about 8 carbon atoms.

10. (Cancelled) ~~The combination of claim 1 wherein said lubricant is characterized as having an ash content below 1.0 wt%, or desirably less than 0.5 wt% or more preferably less than 0.2 wt% of sulfated ash in the lubricant.~~

11. (Original) The combination of claim 1 wherein said lubricant is an ashless engine oil comprising at least one dispersant, at least one antioxidant and combinations thereof.

12. (Currently Amended) The combination of claim 11 wherein the ashless dispersant is selected from the group consisting of at least one of a polyisobutenyl succinimide, high molecular weight succinic esters, Mannich dispersants, carboxylic dispersants, amine dispersants, polymeric dispersants, and combinations thereof; and

at least one antioxidant selected from the group consisting of 2, 6-di-tertiary butyl-4-methyl phenol, phenate sulfides, phosphosulfurized terpenes, sulfurized esters, aromatic amines, diphenyl amines, alkylated diphenyl amines, hindered phenols, bis-nonylated diphenylamine, nonyl diphenylamine, octyl diphenylamine, bis-octylated diphenylamine, bis-decylated diphenylamine, diphenylamine, to 2,6-di-tert-butylphenol, 4-methyl-2,6-di-tert-butylphenol, 4-ethyl-2,6-di-tert-butylphenol, 4-propyl-2,6-di-tert-butylphenol, 4-butyl-2,6-di-tert-butylphenol, 2,6-di-tert-butylphenol, 4-pentyl-2,6-di-tert-butylphenol, 4-hexyl-2,6-di-tert-butylphenol, 4-heptyl-2,6-di-tert-butylphenol, 4-(2-ethylhexyl)-2,6-di-tert-butylphenol, 4-octyl-2,6-di-tert-butylphenol, 4-nonyl-2,6-di-tert-butylphenol, 4-decyl-2,6-di-tert-butylphenol, 4-undecyl-2,6-di-tert-butylphenol, 4-dodecyl-2,6-di-tert-butylphenol, tetra propylene 2,6-di-tert-butylphenol, 4-tridecyl-2,6-di-tert-butylphenol, 4-tetradecyl-2,6-di-tert-butylphenol, methylene-bridged sterically hindered phenols

include but are not limited to 4,4'-methylenebis(6-tert-butyl-o-cresol), 4,4'-methylenebis(2-tert-amyl-o-cresol), 2,2'-methylenebis(4-methyl-6-tert-butylphenol), 4,4'-methylene-bis(2,6-di-tertbutylphenol) 3,5-di-tert-butyl-4-hydroxy hydrocinnamie and (iso-octyl ester butyl ester), and combinations thereof.

13. (Currently Amended) The combination of claim 1 wherein said lubricant is characterized as low ash by having <0.5%, preferably <0.3%, more preferably <0.2% and most preferably <0.1% ash content in the lubricant.

14. (Currently Amended) The combination of claim 1 comprises other lubricant additives selected from the group consisting of ~~anti foams~~, viscosity modifiers, functionalized polymers, corrosion inhibitors, rust inhibitors, viscosity index improvers, pour point depressants, extreme pressure additives, antiwear agents, anti-foam agents, anti-stain additives, anti-foulants and combinations thereof wherein the lubricant additives do not add a significant amount of ash-forming metals to provide <0.5% sulfur or phosphorus compounds to provide <0.05 % phosphorus to the engine oil.

15. (Currently Amended) An internal combustion engine comprising:

(a) an emulsified fuel comprising (1) water, (2) a fuel and (3) an emulsifier comprising:

(i) at least one fuel-soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine including ~~but not limited to~~ alkanol amine, hydroxy amine, ~~and the like,~~ the hydrocarbyl substituent of said acylating agent having about 50 to about 500 carbon atoms;

(ii) a second (meaning another acylating agent than in (i)) acylating agent having at least one hydrocarbyl substituents of up to about 40 carbon atoms, and reacting that said acylating agent with ammonia or an amine;

(iii) at least one of an ionic or nonionic compound having a hydrophilic-lipophilic balance (HLB) of about 1 to about 40;

(iv) a mixture of (i) with (ii) or (iii);

(v) a water-soluble compound selected from the group consisting of amine salts, ammonium salts, azide compounds, nitrate

esters, nitramine, nitro compounds, alkali metal salts, alkaline earth metal salts, in combination with (i), (ii), (iii) or (v) or combinations therein;

(vi) the reaction product of polyacidic polymer with at least one fuel soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia, an amine, a polyamine, an alkanol amine or hydroxyl amines;

(vii) an amino alkylphenol which is made by reacting an alkylphenol; or

(viii) any combination of (i), (ii), (iii), (iv), (v), (vi) and (vii);

(b) at least one lubricant selected from the group consisting of low ash, no ash, low phosphorous, no phosphorous, low sulfur, no sulfur, low chlorine and combinations thereof in an oil of lubrications viscosity, wherein said lubricant is characterized as having an ash content below 1.0 wt%;

resulting in the reduction of emissions selected from the group comprised in particulate matter, NOx, hydrocarbon, soot in combinations thereof.

16. (Original) The internal combustion engine of claim 15 wherein said lubricant is an ashless engine oil comprising at least one dispersant, at least one antioxidant and combinations thereof and wherein the sulfur content in <0.5% of the engine oil, the chlorine content is <100ppm, the phosphorus content is <0.05 of the engine oil and it is low to no ash content.

17. (Original) An internal combustion engine of claim 15 further comprising an exhaust after-treatment device that traps particulates oxidizes and reduces selected exhaust gas components, or traps and converts NOx to other compounds or said engine is equipped with a system to re-circulate exhaust gases to the intake air supply for said engines.

18. (Original) A method for reducing emissions in an engine comprising

(a) using an emulsified fuel, and (b) at least one lubricant selected from the group consisting of low ash, no ash, low phosphorous, no phosphorous, low sulfur, no sulfur, low chlorine and combinations thereof in an oil of lubricating viscosity; and

(c) further comprising at least one dispersant, at least one antioxidant and combinations thereof.

19. (Currently Amended) The method of claim 18 further comprising

(a) an emulsified fuel comprising (1) water, (2) a fuel and (3) an emulsifier wherein the emulsifier comprises:

(i) at least one fuel-soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine including ~~but not limited to~~ alkanol amine, hydroxy amine, ~~and the like~~, the hydrocarbyl substituent of said acylating agent having about 50 to about 500 carbon atoms;

(ii) a second (meaning another acylating agent than in (i)) acylating agent having at least one hydrocarbyl substituents of up to about 40 carbon atoms, and reacting that said acylating agent with ammonia or an amine;

(iii) at least one of an ionic or nonionic compound having a hydrophilic-lipophilic balance (HLB) of about 1 to about 40;

(iv) a mixture of (i) with (ii) or (iii);

(v) a water-soluble compound selected from the group consisting of amine salts, ammonium salts, azide compounds, nitrate esters, nitramine, nitro compounds, alkali metal salts, alkaline earth metal salts, in combination with (i), (ii), (iii), (iv), (vi) or (vii) or combinations therein;

(vi) the reaction product of polyacidic polymer with at least one fuel soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia, an amine, a polyamine, an alkanol amine or hydroxyl amines;

(vii) an amino alkylphenol which is made by reacting an alkylphenol; or

(viii) any combination of (i), (ii), (iii), (iv), (v), (vi) and (vii);

(b) at least one lubricant selected from the group consisting of low ash, no ash, low phosphorous, no phosphorous, low sulfur, no sulfur, low chlorine and combinations thereof in an oil of lubricating viscosity supplying

lubricants to one or more parts in the engine, wherein said lubricant is characterized as having an ash content below 1.0 wt%;
resulting in the reduction of engine emissions selected from the group consisting of particulate matter, NOx, hydrocarbons, soot and combinations thereof.

20. (Currently Amended) The method of claim 18 further comprising at least one of a lubricant additive selected from the group consisting of anti-foams, viscosity modifiers, functionalized polymers, corrosion inhibitors, rust inhibitors, viscosity index improvers, pour point depressants, extreme pressure additives, anti-foam agents, anti-stain additives, anti-foulants and detergents and combinations thereof wherein the lubricant additives add little to no ash forming metals to provide <0.5% sulfur or phosphorus compounds to provide <0.05 % phosphorus to the engine oil.

21. (New Claim) The combination of claim 1, wherein the lubricant has an ash content of <0.8 wt %.